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1704

Discussion  
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# Decentralization and Public Procurement Performance

New Evidence from Italy

Olga Chiappinelli

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#### IMPRESSUM

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# Decentralization and Public Procurement Performance: New Evidence from Italy

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## Abstract

We exploit a new dataset based on EU procurement award notices to investigate the relationship between the degree of centralization of public procurement and its performance. We focus on the case of Italy, where all levels of government, along with a number of other public institutions, are involved in procurement and are subject to the same EU regulation. We find that i) municipalities and utilities, which currently award the largest shares of contracts, perform worse than all other institutional categories; and ii) decentralization implies lower performance only when it comes with weak competences of procurement officials. The evidence seems to suggest that a re-organization of the procurement system, both in terms of partial centralization and better professionalization of procurement officials, would help improve overall procurement performance.

**Keywords:** Public Procurement; Decentralization; Procurement performance; Public works

**JEL Classification:** H11; H57; H71; H77

## 1 Introduction

Accounting for about 15-20% of GDP in developed economies, public procurement is both a paramount economic phenomenon and a leading activity of governments (OECD (2013)).<sup>1</sup> Thus, it is essential that governments design and implement sound public procurement policies and practices in order to achieve best value for money when purchasing those goods and services needed to address public needs. This

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<sup>1</sup>The average for OECD countries is 12% when excluding procurement by state-owned enterprises. When these purchases are also accounted for, the size of procurement can increase by an additional 2 to 13 percentage points of GDP (OECD (2013)).

is particularly compelling in an era of economic instability and crisis, where a key concern for governments is achieving savings in order to consolidate public finances and clear fiscal space for other necessary policies.

A central issue in the debate on how to improve the performance of public procurement spending, is how much public procurement should be centralized i.e., whether procurement should be mostly administered by central governments (or agencies) or rather delegated to sub-central levels of authority. In practice, although many countries have increased their degree of procurement centralization, often with the institution of a central procurement agency concluding procurement agreements on behalf of other public purchasers, public procurement largely remains decentralized.<sup>2</sup> In many OECD countries, local governments and other decentralized units account for substantial percentages of procurement spending (on average 48% in OECD (OECD (2013))).<sup>3</sup>

Consequently, what is natural and relevant to ask is whether such a prevailing decentralization practice in procurement systems is justifiable on economic grounds or whether public purchasing should be rather more centralized and, if so, to what extent.

The aim of this paper is to contribute to answering this question. In particular, we exploit a new dataset based on mandatory contract award notices in the European Union (EU), to provide an empirical assessment of the relationship between procurement decentralization and procurement performance in Italy. The Italian case is appropriate and interesting in this context since all levels of government (central and sub-central) plus a number of other public institutions (e.g., local health authorities, universities, state-owned enterprises) are involved in the procurement of goods, services and works, and are largely subjected to the same rules, at least as far as EU-relevant procurement is concerned.

We consider winning rebate (i.e., the winning bid expressed as a discount with respect to the auction base) as a measure of procurement performance and focus on the award of work contracts. Our main result is that municipalities and utilities (i.e., public enterprises in charge of water, energy, transport and telecommunications services) perform worse than all other institutional categories and, in particular, than more central levels of government. This is particularly relevant insofar as municipalities and utilities award large shares of procurement contracts (respectively 12% and 25% in our data). According to our main estimates, if a tender awarded by a municipality were instead awarded by, for example, a region, the winning rebate would on average increase by around 13% , which would result in an average per-tender saving of almost 2 million euros. Similarly, if a tender awarded by an utility were awarded by central government, the winning rebate would on average increase

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<sup>2</sup>Centralization usually occurs in the form of the stipulation of so called “framework agreements” signed by central procurement agencies on behalf of public purchasers. Framework agreements are agreements between one or more contracting authorities and one or more economic operators, the purpose of which is to establish the terms governing contracts to be awarded during a given period, in particular with regard to price and, where appropriate, quantity (see Dimitri et al. (2006b)).

<sup>3</sup>See McCue and Pitzer (2000) for an overview on recent trends on centralization in public procurement.

by 5%, which would induce a per-tender saving of about 725,000 euros.<sup>4</sup>

We find that even after controlling for other important determinants of the winning rebate, such as the auction characteristics, geographical factors, and social factors, significant differentials remain between institutional categories, suggesting that there are other unobservable factors differing between buyers types that impact the performance of procurement as measured by the winning rebate.

Investigating the possible determinants of these differentials, we find that the competences and monetary incentives of procurement officials in the contracting authorities may have a central role. In particular, we find that categories of contracting authorities where competences are, on average, higher, have a higher performance. Higher wages in absence of competences do not improve performance (they might actually worsen it), while higher wages for competent officials can further improve performance.

What emerges from these results is that decentralization implies worse procurement performance only if it does not come with proper competences. This is the case for municipalities and utilities, while other decentralized purchasing units as public institutions, where competences are higher, seem to have a rather good performance. This is not necessarily a matter of size, such that larger authorities manage to concentrate more qualified bureaucrats, but also of other institutional factors that, for a given degree of centralization, drive some categories (e.g., public institutions) to employ more qualified people. Thus, the policy implication that seems to emerge from our analysis is that procurement should not necessarily be more centralized, rather just in those cases where decentralization results in a lack of professional competences needed to efficiently administer the procurement process, such as municipalities and utilities.

Our work relates to mainly two strands of literature. The former is fiscal federalism and the political economy of the provision of public goods. At the heart of the decentralization issue in public procurement is a particular exemplification of the trade-off between responsiveness to local preferences and central internalization of interjurisdictional interdependencies, which underlies the provision of public goods more generally (see e.g., Oates (1985), Besley and Coate (2003) and Oates (2005)): on one hand centralization of purchases creates potential savings both for purchase costs (since suppliers exploit economies of scale) and for process costs (e.g., tender advertisement and organization, and litigation). On the other hand, decentralization responds better to local specific needs, which is particularly important for the procurement of less standardized goods such as infrastructure (see e.g., Dimitri et al. (2006a)).

A sub-strand in this literature investigates whether local authorities are more prone to favoritism and corruption than central ones, due to invested political interests and lobbying of local suppliers, finding mixed evidence (see e.g. Fisman and Gatti (2002), Faguet (2004), Bordignon et al. (2008) and Coviello and Gagliarducci (2017)). Some other works find that performance can be lower at the local level because of lower accountability and greater informational asymmetries, as well as

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<sup>4</sup>These calculations are computed using the fixed effects estimates of the effect of the contracting authority being the region (resp. central government) rather than municipality (resp. utility) on the winning rebate, for a public contract with an average reserve price of about 14.5 million euros.

lower administrative capacity and less well trained public officials (see e.g. Boadway et al. (1999), Vagstad (2000), Reinikka and Svensson (2004) and Besfamille (2004)).

This work also relates to the empirical literature on public procurement performance. While this literature is very broad (see Dimitri et al. (2006b) for a review), previous works focusing on the relationship between the degree of centralization and procurement performance are limited, with mixed empirical evidence. The paper closest to ours is Guccio et al. (2014), who assess the time performance in the execution of public works by different levels of governments in Italy. Similarly to us, they find that local governments (and municipalities in particular) are less efficient (i.e., incur higher time-overruns) than the central government in the procurement of public works. We complement their analysis, adding value with respect to their paper in three ways. First, and most importantly, we investigate the possible determinants of the performance differential. Second, we consider performance at a different procurement stage, namely the award stage. Third, we exploit more recent data, thereby providing a more updated picture of procurement practices in Italy.<sup>5</sup>

Moreover, there are other papers that, albeit not focusing on the performance differential between different levels of government, provide some marginal evidence on this issue. Bandiera et al. (2009), considering purchases of standardized goods by different classes of Italian public purchasers, find, differently from Guccio et al. (2014) and our results, that the least efficient class is central government, while the average municipality is the second most efficient class after semi-autonomous bodies (e.g., local health authorities and universities). D’Alpaos et al. (2013) in a study about the opportunistic use of time overruns in public works, also find that municipalities, although awarding the largest number of contracts, show higher cost-overruns than the average of the dataset; Decarolis (2014), also shows that municipalities are typically associated with higher cost-overruns (with respect to provinces); Guccio et al. (2012) in a study about determinants of cost-overruns in public works, find, like Bandiera et al. (2009), that all institutional levels of purchasers tend to have lower adaptation costs than the central government, while the evidence about local governments is not significant<sup>6</sup>. They argue that this result can be explained on the grounds that central governments should have greater political incentives for underestimating costs.

The rest of the paper is organized as follows. In Section 2 we describe the Italian institutional background for public procurement, while in Section 3 we describe the data and the criteria to extract and prepare the dataset of interest. In Section 4 we present the empirical model on the impact of the institutional type of the contracting authority on procurement performance, and report estimation results (Subsection 4.1). Next we implement some robustness checks (Subsection 4.2). In Section 5 we discuss and test possible determinants of the performance differentials. We conclude and discuss possible policy implications of our analysis in Section 6.

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<sup>5</sup>Guccio et al. (2014), as virtually all recent empirical studies on procurement for Italy (see e.g., Bucciol et al. (2013), Coviello and Mariniello (2014), Decarolis and Giorgiantonio (2015), Moretti and Valbonesi (2015), Branzoli and Decarolis (2015), Coviello and Gagliarducci (2017) and Coviello et al. (2017) ), focus on public works contracts and cover the 2000-2005 period.

<sup>6</sup>However, this may be due to the fact that they put all levels of sub-central government (i.e., regions, provinces and municipalities) in the same category, which in our opinion is a too loose classification.

## 2 Institutional Background

Italy is an interesting case study for analyzing variation of procurement performance across different degrees of procurement decentralization. All levels of government, plus a variety of other public institutions, are involved in the procurement of goods, services and works, and are mostly subject to the same rules. This is especially the case for larger tenders (i.e., tenders with starting price higher than given thresholds) that are of EU relevance as well as regulated by EU Directives (2004/17/EC (EC (2004a)) and 2004/18/EC (EC (2004b))).<sup>7</sup> In this case the Italian parliament must establish procurement rules according to the principles of the relevant EU legislation, and sub-central governments have limited power to implement changes to the national legislation (see e.g., Decarolis and Giorgiantonio (2015)). The main implication is that all public purchasers in Italy procure largely according to the same rules. Hence, the differences in performance are not attributable to differences in the rules, but rather to specific characteristics of different categories of public purchasers (see Guccio et al. (2014)).

The EU regulation gives provisions, among other things, about a) the public subjects allowed to act as contracting authorities; b) the award procedures; and c) the award criteria.

Regarding the subjects allowed to act as contracting authorities, it is provided that such subjects are: *central government, local governments (i.e., regions, provinces, municipalities, mountain village councils), public institutions with non-economic purpose, bodies of public law, publicly financed enterprises that realize works or produce goods or services that are not destined to free competition markets, concessionaires and other private subjects* in some limited circumstances.

As for the award procedures, three main options are identified: *open procedure, restricted procedure and negotiated procedure*, the latter having two suboptions i.e., *negotiated with call for competition* and *negotiated without call for competition*.<sup>8</sup> Each procedure allows a varying degree of control over the award mechanism and of the interaction with tenderers. In the open procedure, all interested suppliers can submit a tender. In the restricted procedure, there is a shortlisting stage before the tender stage, which enables the contracting authority verify in advance whether potential suppliers have the appropriate experience and resources to meet its needs. In the negotiated procedure, the contracting authority instead invites a restricted number of firms with whom it negotiates the terms of the contract before the awarding. According to EU regulation, while the open and the restricted procedures can be used without restrictions, the negotiated procedure with call for competition should

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<sup>7</sup>These directives were transposed in Italian law by the Legislative Decree 12 April 2006, n. 163, the so-called “Code of public contracts of works, supplies and services”. Information on thresholds can be found at [http://ec.europa.eu/growth/single-market/public-procurement/rules/current/index\\_en.htm](http://ec.europa.eu/growth/single-market/public-procurement/rules/current/index_en.htm). In 2014, new Directives updated the regulation; however, these are still in the process of being transposed into Member States legislation. These are Directive 2014/24/EU (EU (2014b)), which will repeal Directive 2004/18/EC, Directive 2014/25/EU (EU (2014c)), which will repeal Directive 2004/17/EC, and Directive 2014/23/EU (EU (2014a)), which provides a new, separate regulation for concessions.

<sup>8</sup>Note that there is a fourth option, which is rarely used very, called *competitive dialogue*, which was introduced for addressing particularly complex procurement contracting situations, where the contracting authority needs to “dialogue” with potential suppliers before the award phase.



only be used in restricted circumstances, and the negotiated procedure without call for competition can be used only in very exceptional cases, namely when a supplier is the sole source of the good or service required, in cases of extreme urgency, or when the precise specification can only be determined by negotiation.

As for the award criteria, the regulation states that contracts are either awarded via the *lowest price* criterion, or the criterion of the *most economically advantageous tender* (aka MET or MEAT), where some other criteria are considered beside price for the award of the tender (e.g., quality, environmental characteristics etc).<sup>9</sup> In the former case, participants simply bid the price at which they are willing to implement the contract, in the form of a percentage reduction, so called “rebate”, with respect to the reserve price (i.e., the auction’s starting price as announced by the contracting authority). The winner is the participant offering the highest rebate. In the latter, participants submit a complex bid composed of an economic part, based on the offered rebate, and a technical part, detailing how the contract will be implemented with respect to the other (non-price) criteria. The contracting authority sets a scoring rule (i.e., weights given to different components) and the contract is awarded to the participant who has the highest score. Therefore, in this case the highest rebate is not necessarily the winning rebate.<sup>10</sup>

### 3 Data

The data we use are part of a unique dataset based on mandatory contract award notices published on Tenders Electronic Daily (TED), which is the official online version of the Supplement of the Official Journal of the European Union (OJEU).<sup>11</sup> Contracting authorities are obliged to publish contract notices (i.e., calls for tenders) and award notices on TED for all contracts with reserve price exceeding the EU public procurement thresholds.

The original sample is a multi-year cross-section relative to contracts of services, supplies, and works awarded in Italy from 2008 to 2015. The observation unit is the single contract award. For each observation the dataset includes the following information: name, address, and institutional category of the contracting authority; name and address of the winning firm; object of the contract according to the Common Procurement Vocabulary (CPV) coding;<sup>12</sup> type of contract (supply vs service vs work); initial value of the contract (i.e., reserve price); final price of the contract

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<sup>9</sup>In the language of auction theory, the first case corresponds to a (reversed) first-price sealed-bid auction, while the latter to a scoring auction (see e.g., Klemperer (2004)).

<sup>10</sup>As a matter of fact, this can happen also under the criterion of the lowest price, due to a complex mechanism, called “average bid auction”, implemented to prevent firms from overbidding (i.e. to offer too high a rebate, that would later jeopardize contract implementation): the bids that, after a preliminary trimming of the top/bottom 10% of the collected bids, exceed the average by more than the average deviation, are inspected and may be excluded, in which case the winning bid is the highest among the remaining bids. However, there is some evidence that average bidding tends to lowest price (first price) auction (see e.g., Galavotti et al. (2017)).

<sup>11</sup>©European Union 1998-2015, <http://ted.europa.eu>.

<sup>12</sup>The object of contract is defined by 8-digit CPV code. The first 2 digits of the code indicate macro category of the product and the rest of the code details the product (e.g., 45000000 indicates macro category “Construction works”, 45100000 “Site preparation work”, 45110000 “Building demolition and wrecking work and earthmoving work” and so on with increasing detail. For more details

(i.e., the price at which the contract is awarded); date of award of the contract; award criterion; award procedure; number of offers received; number of lots if the contract was divided in lots; whether an electronic auction was used; whether the tender was covered by the Government Procurement Agreement (GPA) or related to EU funded projects; and whether the contracting authority was operating on behalf of some other entity.

Our measure of procurement performance is the winning rebate, defined as the percentage discount of the final price over the reserve price. More formally,  $\text{rebate} = \frac{\text{reserve price} - \text{final price}}{\text{reserve price}} \times 100$ . The winning rebate is a standard measure of ex-ante performance in procurement, indicating the extent to which the functioning of the award process, as administered by the contracting authority, allows the latter to achieve a discount with respect to the maximum price it would have been willing to pay (see e.g., Coviello and Gagliarducci (2017), Coviello and Mariniello (2014), Decarolis and Giorgiantonio (2015), Decarolis (2014)).

From the original sample, we extracted the sample of interest according to the following criteria. First, since our main measure of procurement performance is the winning rebate in each contract award, we kept only observations for which neither the reserve price nor the final price were missing<sup>13</sup>. For the same reason, we excluded cases where it was not possible to clearly define the winning rebate, namely multi-lot contracts (where the contract is divided in parts (i.e., lots) that are awarded separately).

Second, we have restricted the analysis to work contracts (around 10% of the original data - services contracts accounted for around 75% of the data and supplies for around 15%), as the winning rebate is very likely to be endogenous in the case of supplies and services. This is because the reserve price is determined by an employee in the contracting authority, who can overestimate or underestimate the value of the contract. Therefore, a high (low) winning rebate may not indicate a good (bad) performance of the procurement process. This potential endogeneity problem is likely to be weaker in the case of work contracts (relative to services and supplies contracts) as for works there are reference prices based on menu costs (e.g., cost of asphalt per meter) (see e.g., Decarolis (2014) and Galavotti et al. (2017)).

Another reason to limit the analysis to work contracts is related to the fact that when the tenders are awarded with the MEAT criterion, the rebate is only one part of the bid. In the case of works, where quality is more standard, the price component of the bid approximates quite well a bid only based on price, while in the case of services and supplies the firms can give strategically more or less weight to the price component depending on how sophisticated they anticipate the contracting authority will be in evaluating quality ex-post.

Third, since in many cases award notices of tenders below EU regulation thresholds are also reported, we have dropped them, as they fall under a different regulation. Fourth, observations for which the main award characteristics were missing (number of offers, award procedure and criterion, type of contract, CPV codes, year

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on the CPV coding see [http://ec.europa.eu/growth/single-market/public-procurement/rules/cpv/index\\_en.htm](http://ec.europa.eu/growth/single-market/public-procurement/rules/cpv/index_en.htm).

<sup>13</sup>There are many missings in the data, probably due to scarce attention in the compiling of the original award notice documents

of award) were dropped.

Further, we implemented the following steps to prepare the data. First, we changed the institutional categorization of contracting authorities with respect to that provided in the TED data. The original classification was inadequate for our purposes insofar it was not precise enough in terms of local authorities (e.g., regions, municipalities and provinces were put in the same category, while they are very different entities in Italy) and somehow redundant to other categories.<sup>14</sup> Similar to that adopted in Guccio et al. (2014), our new categorization of contracting authorities for Italy is a meaningful and not cumbersome one according to the discussion in Section 2. It consists of the following categories: *central government*, *region*, *province*, *municipality*, public institution, to be divided in *semi-autonomous institution* and *other institution*, *public enterprise*, *utility*, and *private*. *Central government* includes ministries and parliament. *Municipality* includes municipalities, mountain councils and unions of municipalities. With *semi-autonomous institution*, we refer to those public bodies with relative budgetary and administrative autonomy, namely local health authorities, public hospitals and universities.<sup>15</sup> *Other institution* includes all other public bodies that are not included in *semi-autonomous institution*.<sup>16</sup> *Utility* includes all firms using (mostly) public money to provide water, energy, transport and telecommunications services (e.g., “Anas”, “Ferrovie dello Stato”, “Poste Italiane” etc.). *Public enterprise* includes all other firms using (mostly) public money that are in charge of public services other than utilities (e.g., waste collection). *Private* refers to private concessionaires (e.g., those in charge of building and managing highways) that must follow EU regulations when acting as contracting authorities.

Second, we reduced the original TED classification of award procedures to a more synthetic but comprehensive one: open, restricted, negotiated, and no call (the latter referring to those cases where a contract was awarded without prior call for competition)<sup>17</sup>. Third, from initial CPV codes we created 45 macro product categories. We restricted the analysis to sectors in which all institutional categories of contracting authority have at least 5 awards. Last, since in the original data there is only information on the town of the contracting authority and the winning firm, we used postal codes to create further geographical variables, namely province and region of the contracting authority and of the winning firm.

As a result of this cleaning and preparation procedure, our final sample consists

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<sup>14</sup>The original TED classification had 12 categories: *Central government*, *Armed forces*, *Local authorities*, *Water, energy, transport and telecommunications sectors*, *European Union institution/agency*, *other international organization*, *Body governed by public law*, *Other*, *Not applicable*, *National or federal Agency/Office*, *Regional or local Agency/Office*, *Not specified*. We dropped from the analysis contracts awarded by European bodies and those for which the contracting authority was neither specified nor possible to identify through keyword search.

<sup>15</sup>We borrow this definition from Bandiera et al. (2009).

<sup>16</sup>In our sample these include, among the others: institutions for public residential housing, Chambers of Commerce, nursing homes, research institutes, sport federations, the National Institute for the Workers Insurance (Inail), the National Institute for Social Security (Inps), the National Statistical Institute (Istat), and the Bank of Italy.

<sup>17</sup>The original TED classification had 9 categories: Accelerated negotiated procedure, Accelerated restricted procedure, Award of contract without prior publication of a contract notice, Competitive dialogue, Negotiated procedure, Negotiated without a call for competition, Open procedure, Restricted procedure.

of 840 observations of awards of public work contracts, across 8 industrial macro-sectors (as identified by the CPV codes) and awarded between 2008 and 2015 in the 20 Italian regions by contracting authorities belonging to different institutional classes. We complemented these data with information from the National Statistical Institute on the number of residents of the province where the contracting authority was located (ISTAT (2011)).

### 3.1 Descriptive Statistics

Table 1 summarizes the descriptive statistics of our data. The average of winning rebate was 23.7%, with a standard deviation of 15.6%. The minimum rebate was 0% and the maximum 75.7%. Figure 2 in the Appendix plots the empirical distribution of winning rebate.

Our regressor of interest is the institutional category of the contracting authority (*CA type*). In our sample the majority of contracts (31%) were awarded by public institutions (8% by semi-autonomous institutions, and 23% by other institutions), followed by utilities (25%), public enterprises (17%), municipalities (12%), provinces (7%), regions (7%) and central government (3%).<sup>18</sup> From these figures, it is clear that works procurement is largely decentralized in Italy, with public institutions, enterprises and local levels of government awarding most of the contracts.

The average value of the awarded contracts (*reserve price*) was about 14.5 million euros. The average number of bidders participating in the auctions (*offers number*) was 13.7.<sup>19</sup> Competition was rather low: 12.3% of the auctions received only one offer, around 30% of the auctions five offers or fewer, while 50% of the auctions ten offers or fewer. In 26% of the cases the winning firm was located in the same province as the contracting authority (*local win*).

As for the award procedures, 70% of the tenders were awarded via the open procedure, while the restricted procedure was used in 22% of the cases. The negotiated procedure was used in 8% of the cases, the majority of which were without a prior call for competition. The latter figure shows an abnormally high usage of the negotiated procedure, which according to the regulatory prescription, should be used only in very specific cases. In particular, the negotiated procedure without a call for competition (which was used in 5% of the awards) was used often regardless of the legal requirement that it should be used only in exceptional cases (typically, emergencies). Half of the contracts were awarded with the lowest price criterion and half with the MEAT criterion.

As for the object of the contracts, the great majority of tenders concerned construction works (96.5%). Awards were uniformly distributed over the years and geographically.

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<sup>18</sup>The category of private authorities was dropped from the analysis because of too few observations

<sup>19</sup>We excluded outliers with none or more than 100 bidders.

Table 1: Summary statistics, works contracts

Variable	Mean	Std. Dev.	Min.	Max.	N
Dep. variable:					
win. rebate (%)	23.67	15.62	0	75.68	840
CA type:					
central government	0.03	0.16	0	1	840
region	0.07	0.25	0	1	840
province	0.07	0.26	0	1	840
municipality	0.12	0.32	0	1	840
public institution:					
<i>semi-auto. institution</i>	0.08	0.26	0	1	840
<i>other institution</i>	0.23	0.42	0	1	840
public enterprise	0.17	0.37	0	1	840
utility	0.25	0.43	0	1	840
Auction characteristics:					
offers number	13.71	12.83	1	78	840
reserve price	1452.46	1245.65	480.65	7115.2	840
award procedure:					
<i>open</i>	0.70	0.46	0	1	840
<i>restricted</i>	0.22	0.42	0	1	840
<i>negotiated</i>	0.03	0.17	0	1	840
<i>negotiated without call</i>	0.05	0.22	0	1	840
award criterion:					
<i>MEAT</i>	0.49	0.5	0	1	840
<i>lowest price</i>	0.51	0.5	0	1	840
local win	0.26	0.44	0	1	840
Province characteristics:					
population	2177.02	1663.92	127.06	4340.47	840

Notes: *Reserve price* is expressed in 10,000 euros and in 2010 equivalents. *Population* is expressed in 1,000 inhabitants. For a full description of variables, see Subsection 7.1 in the Appendix. Source: our elaboration on TED data.

## 4 Empirical Analysis

We are interested in estimating the relationship between the institutional class of the contracting authority and the winning rebate, used as a measure of procurement (ex-ante) performance. Figure 1 shows some preliminary evidence about the relation of interest. Average winning rebate is lowest for utilities. Public enterprises and municipalities also show lower rebates than other categories. Provinces and regions display the highest rebates. In particular is worth noting that municipalities display lower rebates than all other governmental levels. This ranking is confirmed in Table 6 (in the Appendix), which presents the summary statistics of rebate by institutional type.

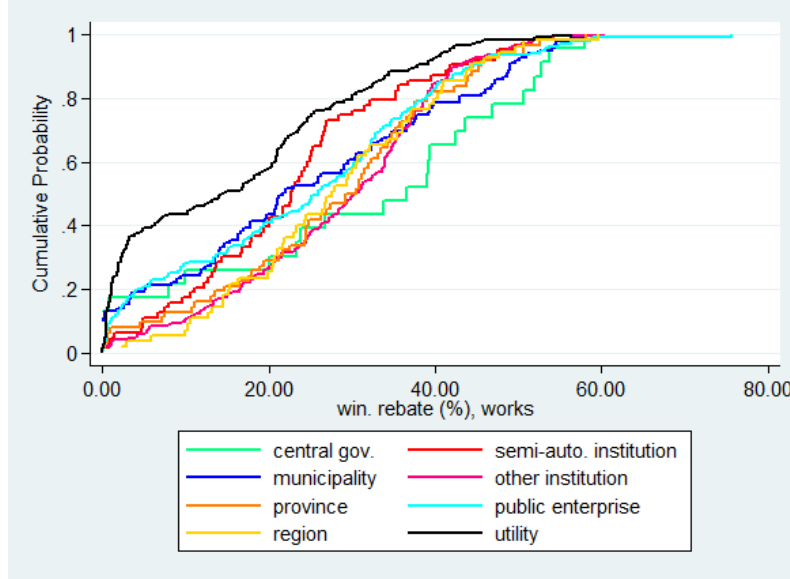


Figure 1: Empirical cumulative distribution of winning rebate by CA type, works contracts. Source: our elaboration on TED data.

From this preliminary evidence it seems that some decentralized units have a relatively lower procurement performance, as measured by average winning rebate, relative to more central ones. Next, we perform a regression analysis to estimate the effect of the institutional class of the contracting authority on the winning rebate, while controlling for other important factors that may influence the winning rebate.

We consider award-level data and we estimate different versions of the following specification:

$$rebate_{irts} = \alpha + CA'\beta + X_i'\delta + \gamma_r + \eta_s + \theta_t + \epsilon_{irts} \quad (1)$$

where  $rebate_{irts}$  is the winning rebate in tender  $i$ , awarded in region  $r$  and in year  $t$ , with contact object relative to industrial sector  $s$ .  $CA$  is a vector of eight dummies, one for each institutional class of contracting authority.  $\beta$  is the vector of coefficients of interest.  $X_i$  is a vector of characteristics of the award  $i$ ,  $\gamma_r$  are region fixed effects,  $\eta_s$  are sector fixed effects,  $\theta_t$  are year fixed effects,  $\epsilon_{irts}$  is the usual white noise component.

The vector  $X_i$  is a set of controls including i) auction and contract characteristics;

and ii) province characteristics. As auction characteristics we include the following variables: the reserve price, which accounts for heterogeneity between purchases, to control for the fact that firms can offer higher rebates on larger contracts because of economies of scale; the number of offers, which measures the degree of competition in the auction and is expected to have a positive impact on the winning rebate; the award procedure (four dummies), to account for the fact that less open procedures will reduce the number of bidders and therefore impact negatively on rebate; and a dummy to control whether the winner was in the same province as the contracting authority or not. The expected impact of this variable on rebate is ex-ante unclear. On one hand, local firms may reflect their lower transportation and logistic costs in their bid, which would make a local win impact positively on rebate. On the other hand, local firms could win even if they are not the most competitive supplier because the CA may prefer local firms even if they are not the best available suppliers, which could have a negative effect on rebate.

To control for size effects, in absence of data on annual expenditure of CAs, we included *population*, i.e., resident population (in 1,000 inhabitants) in the province of the CA. Size effects may be important, since larger provinces may have more potential competitors in auctions and larger CAs, which may systematically award larger contracts.

Region fixed effects, i.e., a set of dummies for Italian regions, capture unobservable local characteristics that are constant (or slowly changing) over time. These include the levels of social capital, corruption, accountability, and other long-term institutional characteristics that can impact procurement performance and, thus, rebate.<sup>20</sup> Sector fixed effects (i.e., a set of dummies for all the macro industrial sectors) control for sector or market specific time-invariant characteristics. Year fixed effects, namely a set of indicators for the year of award (2008-2015) control for possible time effects.

These cross-sectional (at the region and at the sector level) and over-time variations lie at the heart of identification of the relationship of interest, which is the impact of the institutional category of the contracting authority on winning rebate. We estimate model (1) using OLS and clustering the standard errors at sector level.

## 4.1 Empirical Evidence

Table 2 reports the results from estimating three different specifications of equation 1. Column (1) includes only the regressor of interest, i.e., the set of dummies for the institutional class of the contracting authority and fixed effects (region, year, and sector fixed effects). Column (2) also includes auction controls and province population. Column (3) further adds the interaction term between institutional category of the contracting authority and region fixed effects, which allows the impact on rebate of local unobservables, such as quality and accountability of local institutions, to differ depending on the type of purchaser. In all three specifications the omitted category for the institutional class is *utility*.

Results in the baseline specification (1) confirm existing evidence (and in par-

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<sup>20</sup>Given the limited sample size, we preferred region fixed effects (20 dummies) to province fixed effects (110) dummies.

ticular results in Guccio et al. (2014)), namely that municipalities perform worse than more central levels of government. According to this preliminary evidence, also other decentralized buying units such as semi-autonomous institutions and public enterprises seem to be comparable to municipalities in terms of performance. By far, utilities are the least efficient category.

Taking into account auction characteristics quantitatively and qualitatively changes the baseline estimates, indicating that not including them in the analysis would cause omitted variable bias. Estimates in specification (3) confirm that municipalities (and provinces) are worse than more central governmental purchasers. The best governmental level (and best performer overall) are regions followed by central government. Also public institutions seem to be efficient in administering procurement of works, even though having more budget autonomy, contrary to expectations, does not seem to induce higher performance, but rather worsens it. Utilities are strongly confirmed to be the worse non-governmental category. This is important because a large share of contracts (25% in our data) is awarded by utilities.

The controls included in columns (2) and (3) have the expected significance and sign. Using a restricted or a negotiated procedure rather than an open procedure (reference category), has a strong and negative impact on average winning rebate. Clearly, using the lowest price as the award criterion increases rebate relative to the case where also quality is taken into account.<sup>21</sup> The coefficients of *population* and of *reserve price* are close to 0 but significant, possibly due to the fact that size effects may be already captured by geographical fixed effects.<sup>22</sup> In addition, the coefficient of *offers number*, albeit with the expected sign and significance, seems to have a weak effect (1 more bidder in the tender induces an increase in average winning rebate of less than 1%), probably because the effect is already captured by the award procedure. The fact that the contract was awarded to a firm in the same province of the contracting authority (*local win*) has a small and negative impact on rebate, suggesting that local winners do not reflect their competitive advantage in terms of lower transportation costs in their offers. Otherwise, this could be a weak evidence of favoritism towards local providers.

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<sup>21</sup>It might be questioned that winning rebate is an imprecise measure of performance when criteria other than the price are also considered for the award of the contract. In subsection 4.2, we run a robustness check where we exclude the contracts awarded with the MEAT criterion.

<sup>22</sup>Size effects could also be captured by institutional categories, if different category of contracting authorities award systematically contracts of different values and different classes of firms select themselves on the categories of buyers. We run a robustness check in subsection 4.2 to exclude this possibility.



Table 2: Winning rebate over CA type, works contracts (OLS)

Dep.variable	(1) win. rebate (%)	(2) win. rebate (%)	(3) win. rebate (%)
<u>CA type</u>			
central gov.	14.624*** (0.185)	1.010*** (0.229)	4.603*** (0.574)
region	13.462*** (0.553)	4.556*** (0.757)	13.351*** (0.227)
province	10.712*** (0.406)	4.378*** (0.104)	-4.323** (1.249)
municipality	7.244*** (0.980)	1.361* (0.599)	-0.129 (0.302)
semi-auto. institution	6.353*** (0.400)	-0.795*** (0.195)	5.273*** (0.235)
other institution	11.192*** (0.349)	4.928*** (0.088)	10.986*** (0.440)
public enterprise	8.852*** (0.482)	5.282*** (0.346)	5.497*** (0.586)
<u>Auction controls</u>			
reserve price		0.000*** (0.000)	0.000*** (0.000)
offers number		0.549*** (0.002)	0.510*** (0.007)
lowest price		4.412*** (0.294)	5.113*** (0.371)
negotiated		-3.452* (1.798)	-2.935** (1.069)
nocall		-16.133*** (0.296)	-14.947*** (0.414)
restricted		-5.590*** (0.243)	-5.584*** (0.189)
local win		-0.735* (0.355)	-1.676*** (0.287)
<u>Province controls</u>			
population		0.002*** (0.000)	0.002*** (0.000)
region FE	Yes	Yes	Yes
year FE	Yes	Yes	Yes
sector FE	Yes	Yes	Yes
CAtypexregion FE	No	No	Yes
Adjusted $R^2$	0.180	0.481	0.490
Observations	840	840	840

Notes: Standard errors robust to clustering at the sector level are in parentheses. The omitted category for the CA type is *utility*. The omitted category for award procedure is *open*. *Reserve price* is expressed in 10,000 euros and in 2010 equivalents. *Population* is expressed in 1,000 inhabitants. For a full description of variables see Subsection 7.1 in the Appendix. Significance levels: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Source: our elaboration on TED data.

Therefore, even if results in Table 2 cannot be automatically given a causal interpretation, there seems to be a systematic statistically significant evidence that there is a general performance mismatch in the Italian system of public procurement, in the sense that the institutional categories that are responsible for among the largest procurement volumes in Italy (i.e., municipalities and utilities), are also the least efficient in procuring.

Moreover, the estimates seem to report that significant differentials remain in the efficiency between institutional categories, even after controlling for other important determinants of rebate, such as the auction characteristics, geographical factors, and social factors. This suggests that there are other structural factors differing between CA types that impact procurement performance, as measured by the winning rebate. In Section 5 we shed light on these determinants. Before that, we next highlight some issues that might affect our analysis and results, and run a number of robustness checks.

## 4.2 Robustness Checks

As already noted, an issue that could affect our analysis is that winning rebate as a performance measure could be prone to endogeneity when the contract is awarded with the MEAT criterion (i.e., also quality is taken into account for the award). In this case bidders can give more or less weight to the price component depending on how able they anticipate the authority will be in evaluating quality ex-post. In particular, they might weight the price relatively more if they anticipate that the buyer will not be able to check quality ex-post. We argue that in the case of works this problem should not be that severe because quality is rather standard, and therefore the price component in a bid based on both price and quality is a rather good proxy of a bid based only on price. However, it is relevant to check whether this is indeed the case.

Therefore, as a first robustness check, we run the same regression as column (3) in the main analysis (whose result are reported in column (1) of Table 3 for ease of comparison) but restrict to the sub-sample of contracts awarded with the lowest-price criterion. Results, reported in column (2) of Table 3, show that most of the institutional coefficients are qualitatively the same and quantitatively larger, suggesting that institutional effects are clearer and higher when the performance measure is cleaner (see full estimates in Table 8 in the Appendix). The predictive power of the model also improves. A result emerging from this new estimation is that public institutions with a semi-autonomous budget management are efficient in procurement (from estimates in (2) they display the highest winning rebates). This is in line with the expectation that a higher reliance on own budget increases the pressure for a contracting authority to administer procurement efficiently, and also in line with the findings of previous literature (see Bandiera et al. (2009) and Guccio et al. (2014)).

Another issue that might affect our results is that different categories of bidders could select themselves on different institutional categories. For example, if larger bidders offer larger rebates because they can exploit economies of scale (for a

given contract value) and some institutional categories attract systematically larger bidders than others, we would see higher winning rebates not because of the institutional effect but because of a size effect. For example, municipalities could display lower rebates than government only because they attract smaller firms. In fact, as reported in Table 7 in the Appendix, some CA types, especially municipalities, award on average smaller contracts than other categories. Therefore, there is some evidence of stochastic dominance of municipalities on the size of the contract. While this problem could be easily solved by including some indicator of the firm size or firm fixed effect, neither of these solutions is viable in our case.

Therefore, as a second robustness check, we estimate the model of interest (in the specification of column (3) of Table 2) restricting to contracts whose value is not larger than the largest contract awarded by municipalities in the sample. This way we are considering more homogeneous awards (similar checks were implemented by Bucciol et al. (2013), Decarolis (2014), Guccio et al. (2014)). The results of this check are reported in column (3) and (4) of Table 3 which consider the full sample and only contracts awarded with the lowest price criterion, respectively. Coefficients of the institutional regressors are robust, showing that size effects are not a concern in our analysis.

As a further robustness check, we change the clustering of errors from the sector to the province level. Results reported in column (5) and (6) of Table 3, show that estimates are generally robust, but more in the specification where only contracts awarded with the lowest price criterion are considered (column (6)). This confirms that in that case our model of interest fits better the data, and estimates are cleaner and more robust.

Table 3: Winning rebate over CA type, works contracts (OLS). Robustness checks.

Dep. variable	(1)	(2)	(3)	(4)	(5)	(6)
CA type	win. rebate (%)	win. rebate (%)	win. rebate (%)	win. rebate (%)	win. rebate (%)	win. rebate (%)
central gov.	4.603*** (0.574)	15.944*** (0.073)	5.223*** (0.626)	16.424*** (0.091)	4.603 (3.547)	15.944*** (4.107)
region	13.351*** (0.227)	14.527*** (0.378)	13.788*** (0.232)	14.411*** (0.433)	13.351*** (2.715)	14.527*** (1.262)
province	-4.323** (1.249)	20.564*** (0.944)	-4.419** (1.494)	19.799*** (0.953)	-4.323 (2.950)	20.564*** (4.617)
municipality	-0.129 (0.302)	-4.438*** (0.358)	0.771* (0.367)	-3.738*** (0.397)	-0.129 (3.582)	-4.438 (3.812)
semi-auto. institution	5.273*** (0.235)	17.335*** (0.682)	5.546*** (0.233)	17.408*** (0.775)	5.273** (2.627)	17.335*** (3.656)
other institution	10.986*** (0.440)	12.932*** (0.130)	10.589*** (0.486)	12.263*** (0.126)	10.986*** (2.207)	12.932*** (1.789)
public enterprise	5.497*** (0.586)	4.356*** (0.415)	6.377*** (0.662)	4.617*** (0.397)	5.497*** (0.970)	4.356*** (0.861)
auction controls	Yes	Yes	Yes	Yes	Yes	Yes
province controls	Yes	Yes	Yes	Yes	Yes	Yes
region FE	Yes	Yes	Yes	Yes	Yes	Yes
year FE	Yes	Yes	Yes	Yes	Yes	Yes
sector FE	Yes	Yes	Yes	Yes	Yes	Yes
CAtypeXregion FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted $R^2$	0.574	0.745	0.578	0.745	0.574	0.745
Observations	840	431	794	409	840	431

Notes: Standard errors robust to clustering at the sector level (columns (1)-(4)) or at the province level (columns (5)-(6)) are in parentheses. Column (1) reports the estimates of the model in column (3) of Table 2. Columns (2), (4) and (6) exclude the contracts awarded with the MEAT criterion. Column (3) and (4) exclude contracts with a reserve value larger than 40 million euros. The omitted category for the CA type is *utility*. Full estimation results are in Table 8 in the Appendix. For a full description of variables see Subsection 7.1 in the Appendix. Significance levels: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Source: our elaboration on TED data.

## 5 Determinants of performance differentials

Public procurement is a complex activity, especially in the case of infrastructure. It requires knowledge and abilities at each procurement stage. At the planning stage, the ability to properly choose and design the project, as well as to estimate its costs (see e.g., Flyvbjerg (2009)); at the award stage, the ability to choose the right award criterion and award procedure in each context; and at the execution stage, the ability to monitor the execution and evaluate ex-post quality (see e.g., Guccio et al. (2014)). Public officials may lack these competences and experiences. This may be especially true at the decentralized level, where purchasing units are on average too small to be able to concentrate and afford specialized and trained procurement officials.<sup>23</sup>

Further, even if procurement officials had the skills to run efficiently the procurement process and minimize costs, they may lack incentives to do so (see e.g., Bandiera et al. (2009)). This could be the case because they are not paid enough or because the contracting authority relies on external funds. This may be, for example, the case for municipalities, which receive most of their financing from central government transfers, as well as public enterprises and utilities, which receive large shares of capital from municipalities or other levels of government.

In the previous sections we found evidence that some decentralized categories of contracting authorities, in particular municipalities and utilities, are less efficient than others (in terms of the average winning rebate they manage to achieve) in awarding contracts for public works. These performance differentials remain even after controlling for other important determinants of rebate, such as the auction characteristics as well as geographical and social factors, suggesting that there are other factors differing between institutional categories of buyers that impact the performance of procurement.

In this section we shed light on what these factors could be. In particular, we consider two possible channels, the *competence channel* and the *incentives channel*, that is the role of, respectively, professional competences and monetary incentives of procurement officials, in explaining rebate differentials.

Competences and incentives will typically vary across categories of purchasers. Therefore, under the conjecture that more competent and/or better incentivized officials administer the procurement process more efficiently, we expect to observe better procurement performance (higher winning rebates) for categories of contracting authorities where officials are, on average, more competent and/or better incentivized.

To test the two channels, we use measures of competences and incentives in different categories of contracting authority and estimate their impact on winning rebate.

As a measure of competence, we use average *literacy* in different categories of public purchasers. This data is taken from the National School of Administration (Tronti et al. (2013)), which regularly conducts surveys on the competences of the public employees.<sup>24</sup> Literacy, defined as the "ability to read, write and understand

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<sup>23</sup>Unlike other countries (e.g., United Kingdom) in Italy there is no specific "procurement official" professional profile and there are no specific education and training programs in place.

<sup>24</sup>The methodology used, called the Job Requirements Approach (JRA), considers different measures of competences and builds indexes on how frequently these competences are acted on

text, expressed by behaviors such as: read and understand short documents such as reports, letters or memos; use a personal computer, calculators or other computerized instruments; write notes or fill in forms correctly (e.g., short reports, letters, memos or e-mail); read information, directives, forms, notices, warnings, email; read and understand long documents such as reports, manuals, articles or books", appears to be a meaningful proxy for the general competence of bureaucrats.<sup>25</sup>

To test the incentive channel, we use data from the Italian National Institute of Statistics (ISTAT) on average yearly wage of employees in each institutional categories.<sup>26</sup>

Values on literacy and yearly earnings by category of contracting authority are reported in Table 4.

Table 4: Channels by institutional class of CA

CA type	literacy	wage
central gov.	49.1	25595
region	52.1	23760
province	52.1	23760
municipality	48.9	23760
semi-auto. institution		
<i>universities</i>	46.6	28112
<i>health authorities, hospitals</i>	45.5	28112
other institution	52	26883
public Enterprise	48.9	33786
utility	48.9	35674

Notes: *literacy* is a frequency index (%) on office-related behaviors that proxy bureaucratic capabilities levels, average for CA type. *wage* is the yearly wage of employees (in euros and 2010 equivalents), average per CA type. For a full description of variables see Subsection 7.1 in the Appendix. Source: our elaboration on National School of Administration (Tronti et al. (2013)) and ISTAT data.

We next estimate different specifications of the following model:

$$rebate_{irts} = \alpha + Channel\beta + X_i'\delta + \gamma_r + \eta_s + \theta_t + \epsilon_{irts} \quad (2)$$

which is the same as model 1, other than the fact that the regressor of interest is now *Channel*, which is a variable capturing each of the two possible channels of performance differentials across institutional categories: average literacy (when

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the job place by employees in different contracting authorities. The same methodology is used by the OECD for the Survey of Adult Skills PIAAC (<http://www.oecd.org/skills/piaac/>). The survey is aimed at assessing the requirements necessary for the interviewee to do his job, in terms of intensity and frequency with which the competences are put in practice for implementing some tasks (e.g., use of electronic sheets, reading books, writing letters, etc.) in the job place.

<sup>25</sup>The other measurements used in the survey are: problem solving, group work, autonomy, mathematical competences, care, analysis and programming, international interaction.

<sup>26</sup>Data are expressed in base year 2010 are available at [http://dati.istat.it/Index.aspx?DataSetCode=DCSC\\_RETRCONTR1C](http://dati.istat.it/Index.aspx?DataSetCode=DCSC_RETRCONTR1C).

we test the competence channel) and average earnings (when we test the incentive channel) per category of contracting authority. We use OLS and cluster the errors at the sector level.

Estimation results are reported in Table 5. Column (1) and (2) report estimates for the test of the competence channel, respectively for the full sample, and for the subset of contracts awarded with the lowest price criterion. Competence has a significant effect on the winning rebate, indicating that some of the observed performance differential is explained by the fact that categories of contracting authorities with better qualified officials perform better in procurement.

For government levels, it appears that more central levels may have higher performance than municipalities because they have better competences. This is probably due to size, in the sense that more centralized units (regions and central government) are larger and are, therefore, able to concentrate more qualified and specialized human resources than municipalities. As for non-governmental purchasers, better human resources can explain why public institutions perform better than utilities and public enterprises.<sup>27</sup> In this case, the explanation does not seem to be related to size, but probably to some other structural factor that makes public institutions employ more competent bureaucrats. The competences channel also seems to explain why semi-autonomous institutions, which rank lowest in terms of literacy, perform worse than other public institutions.

Columns (3) and (4) report estimates of the incentive channel test. Here the result is that having larger incentives in terms of higher wages does not improve the rebate performance, possibly even worsens it (we find a small and negative effect). For example, utilities and public enterprises, which are the categories paying the highest wages, do not seem to be able to provide enough pressure for their employees to implement efficient procurement procedures. This suggests that when competences are very low, as in the utilities and public enterprises cases, higher incentives in terms of higher wages are not enough to guarantee good performance. Thus, a possibility is that higher wages in the absence of competences do not provide sufficient pressure to administer efficiently the procurement process. To test this last conjecture, we add the interaction between literacy and wage to the model (columns (5) and (6)), finding that not only does the sign of wages turns positive, but also that the coefficients of both literacy and wage get much larger. This evidence confirms that (i) paying more to officials lacking competence does not improve (possibly worsens) their procurement performance; and (ii) the effects of competences and wages reinforce each other: increasing the remuneration of officials who are competent improves procurement performance.

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<sup>27</sup>The survey only includes public institutions, so that no values are reported for utilities and public enterprises. We adopted the conjecture that the competences endowment in these bodies is the same as municipalities.

Table 5: Winning rebate over channels, works contracts (OLS).

Dep. variable	(1)	(2)	(3)	(4)	(5)	(6)
	win. rebate (%)	win. rebate (%)	win. rebate (%)	win. rebate (%)	win. rebate (%)	win. rebate (%)
literacy	2.221*** (0.069)	3.118*** (0.059)			5.373*** (1.131)	3.588*** (0.674)
wage			-0.844*** (0.033)	-1.452*** (0.023)	7.809*** (2.027)	4.983*** (1.266)
literacyXwage					-0.172*** (0.042)	-0.131*** (0.026)
auction controls	Yes	Yes	Yes	Yes	Yes	Yes
province controls	Yes	Yes	Yes	Yes	Yes	Yes
region FE	Yes	Yes	Yes	Yes	Yes	Yes
year FE	Yes	Yes	Yes	Yes	Yes	Yes
sector FE	Yes	Yes	Yes	Yes	Yes	Yes
literacyXregion FE	Yes	Yes	No	No	No	No
wageXregion FE	No	No	Yes	Yes	Yes	Yes
Adjusted $R^2$	0.474	0.650	0.471	0.664	0.478	0.662
Observations	840	431	840	431	840	431

Notes: Standard errors robust to clustering at the sector level are in parentheses. Columns (2), (4), and (6) exclude the contracts awarded with the MEAT criterion. Full estimation results are reported in Table 9 in the Appendix. *literacy* is a frequency index (%) on office-related behaviors that proxy bureaucratic capabilities levels, average for CA type. *wage* is the yearly wage of employees (in euros and 2010 equivalents), average per CA type. For a full description of variables see Subsection 7.1 in the Appendix. Significance levels: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Source: our elaboration on TED, NSA and ISTAT data.



## 6 Conclusion

In this paper, we used a new dataset based on EU procurement award notices (TED) to provide new evidence on the relationship between the degree of centralization of a procurement system and its performance. For this purpose, we focused on the procurement of public works in Italy, which is a convenient case study, insofar all levels of governments (plus a number of other categories of public institutions) are involved in procurement and follow substantially the same rules.

We considered the winning rebate as the measure of procurement performance, finding the following results. First, municipalities and utilities are less efficient than other institutional categories, in particular more central levels of government. This is particularly relevant insofar as municipalities and utilities award large shares of procurement contracts. This result also suggests that it is important to focus on the procurement performance of non-governmental buyers, such as utilities, which are neglected because most of the fiscal federalism debate is on the performance of governmental levels (in particular, to show that municipalities are worse performers than more central levels). Second, decentralized authorities do not, in general, perform more poorly than more central ones. While municipalities and utilities perform badly, other decentralized purchasing units, such as public institutions, seem to perform well. Third, performance differentials between different categories remain even after controlling for other important determinants of rebate, such as auction and local characteristics, suggesting that some institutional factors that differ by category play a role. Fourth, competences are likely to be an important determinant of performance differentials. For a given degree of centralization, categories with more competent officials perform better on average. Higher incentives (in terms of higher remuneration) improve performance only if they come together with higher competence.

With the reservations that our results cannot be readily interpreted in causal terms and that they refer only to a sector of procurement (i.e., public works) and a stage of the procurement process (i.e., award stage), the policy implications of our analysis are that i) what is crucial is to improve competences of procurement officials. This can be achieved through the "professionalization" of the public buyer, which should include both specific education programs and increased remuneration, thus fostering motivation and reducing the temptation for corruption; and ii) obtaining this only partially implies more centralization. Some categories of purchasers, probably because of the size or lower budget autonomy (e.g., municipalities, utilities) do not manage to attract qualified human resources; therefore it might be better to shift their procurement needs to more central levels, like regions, which are likely to have better competences, and would also allow for some degree of purchase aggregation. This partial centralization would also ensure that small and medium enterprises (SMEs) are not handicapped with respect to larger competitors.<sup>28</sup> Other decentralized units that already have good endowment of competences (because of budget autonomy or some other institutional factors) should probably continue to administer their own procurement.

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<sup>28</sup>Due to lower production volumes and profit margins, SMEs may find it difficult to compete for big tenders. This would negatively impact competition levels in procurement.

In sectors where potential economies of scale are larger or the government is a dominant purchaser - most notably defence and health - procurement should be probably fully centralized, in order to enable the public purchaser to fully exploit bargaining power and achieve potentially large savings (Dimitri et al. (2006b)). For example, health procurement nowadays largely occurs on a very decentralized basis, i.e., single hospitals and other local health authorities independently procure what they need. In this sector there may be substantial gains from centralization.

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## 7 Appendix

### 7.1 Definitions of the variables

- *winning rebate* is the winning bid expressed as discount (rebate) over the auction's reserve price. Data is our elaboration on TED.
- *reserve price* is the starting value of the tender set by the CA in 10,000 euros (2010 equivalents). Data is from TED.
- *offers number* is the number of bids received in the auction. Data is from TED.
- *CA type* is a set of dummy variables indicating the different types of contracting authority *central government, semi-autonomous institution, municipality, province, public enterprise, utility, region, private* and *other institution*.
- *award procedure* is a set of dummies for the type of award procedure *open, restricted, negotiated* and *negotiated without call*. Data is our elaboration on TED.
- *award criterion* is a set of dummies for the award criterion. *lowest price* and *MEAT*. Data is from TED.
- *contract sector* is a set of 45 dummies indicating macro categorization of contract objects. Data is our elaboration on TED.
- *local win* is a dummy for whether the winning firm was registered in the same province of the CA. Data is our elaboration on TED.
- *population* is the number of resident inhabitants (in 1,000) in the province where the CA is located notes. Data is from ISTAT.
- *macro area: centre, north* and *south* are dummies for the macro-area where the CA is located. Definition of macro-areas is from ISTAT.
- *award year* is a set of 8 dummy variables indicating the year of award
- *award province* is a set of 110 dummies indicating the province of the contracting authority
- *award region* is a set of 20 dummies indicating the region of the contracting authority
- *literacy* is frequency index (%) on behaviors adopted in the work place by procurement officials (read and understand short documents such as reports, letters or memos; use a personal computer, calculators or other computerized instruments; write notes or fill in forms correctly (e.g., short reports, letters, memos or e-mail); read information, directives, forms, notices, warnings, email; read and understand long documents such as reports, manuals, articles or books) on average in different categories of CA. Data is from National School of Administration.

- *wage* is the average yearly wage of employees in each institutional categories, expressed in base year 2010. Data is from ISTAT.

## 7.2 Additional figures and tables

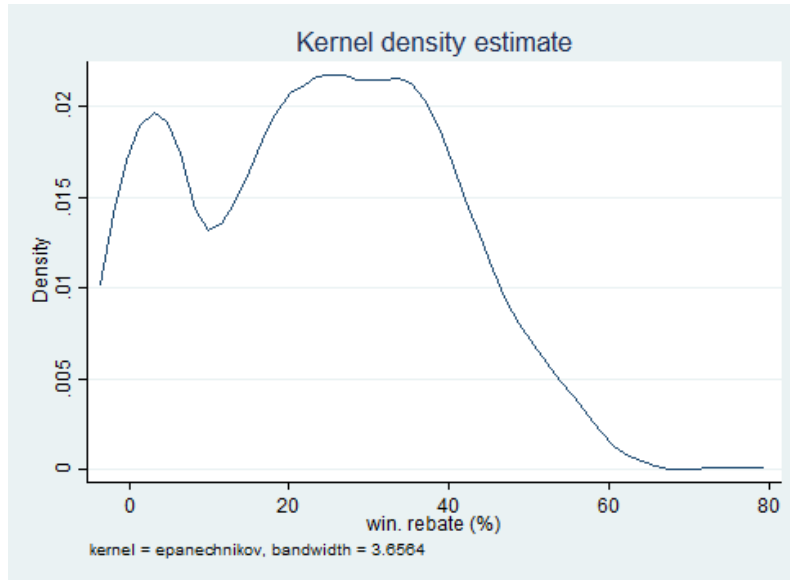


Figure 2: Kernel density of winning rebate, works contracts. Source: our elaboration on TED data.

Table 6: Winning rebate (%) by CA type, works contracts.

CA type	N	mean	sd	p50	min	max
central gov.	23	30.44	19.45	36.54	0.00	57.90
region	55	27.93	12.96	27.52	2.25	59.55
province	62	27.63	14.32	29.86	0.00	58.07
municipality	99	24.59	17.45	21.73	0.00	57.94
semi-auto. institution	63	22.88	13.30	22.73	0.00	54.28
other institution	193	28.17	13.05	30.12	0.00	60.21
public enterprise	139	24.15	16.71	25.91	0.00	75.68
utility	206	15.84	14.49	14.37	0.00	56.41
Total	840	23.67	15.62	24.11	0.00	75.68

Source: our elaboration on TED data.

Table 7: Reserve price by CA type, works contracts.

<b>CA type</b>	<b>N</b>	<b>mean</b>	<b>sd</b>	<b>p50</b>	<b>min</b>	<b>max</b>
central gov.	23	1226.525	993.9784	791.8142	483.6257	4047.244
region	55	1243.412	1077.871	775.4489	485.42	6543.313
province	62	1056.57	740.0127	756.638	480.6547	3830.969
municipality	99	868.6335	482.1771	710.4366	491.3105	3646.454
semi-auto. institution	63	1390.046	1275.029	915.0417	493.0362	6049.661
other institution	193	1623.321	1416.16	1009.698	484.4347	6683.559
public enterprise	139	1727.196	1378.971	1314.99	491.3438	7115.203
utility	206	1606.855	1296.497	1112.973	483.8272	6630.206
<b>Total</b>	<b>840</b>	<b>1452.459</b>	<b>1245.653</b>	<b>945.9236</b>	<b>480.6547</b>	<b>7115.203</b>

Notes: values are expressed in 10,000 euros and 2010 equivalents. Source: our elaboration on TED data.

Table 8: Winning rebate over CA type, works contracts (OLS). Robustness checks. Full estimation results.

Dep. variable	(1) win. rebate (%)	(2) win. rebate (%)	(3) win. rebate (%)	(4) win. rebate (%)	(5) win. rebate (%)	(6) win. rebate (%)
<u>CA type</u>						
central gov.	4.603*** (0.574)	15.944*** (0.073)	5.223*** (0.626)	16.424*** (0.091)	4.603 (3.547)	15.944*** (4.107)
region	13.351*** (0.227)	14.527*** (0.378)	13.788*** (0.232)	14.411*** (0.433)	13.351*** (2.715)	14.527*** (1.262)
province	-4.323** (1.249)	20.564*** (0.944)	-4.419** (1.494)	19.799*** (0.953)	-4.323 (2.950)	20.564*** (4.617)
municipality	-0.129 (0.302)	-4.438*** (0.358)	0.771* (0.367)	-3.738*** (0.397)	-0.129 (3.582)	-4.438 (3.812)
semi-auto. institution	5.273*** (0.235)	17.335*** (0.682)	5.546*** (0.233)	17.408*** (0.775)	5.273** (2.627)	17.335*** (3.656)
other institution	10.986*** (0.440)	12.932*** (0.130)	10.589*** (0.486)	12.263*** (0.126)	10.986*** (2.207)	12.932*** (1.789)
public enterprise	5.497*** (0.586)	4.356*** (0.415)	6.377*** (0.662)	4.617*** (0.397)	5.497*** (0.970)	4.356*** (0.861)
<u>Auction controls</u>						
reserve price	0.000*** (0.000)	-0.000*** (0.000)	0.000 (0.000)	-0.000*** (0.000)	0.000 (0.000)	-0.000 (0.000)
offers number	0.510*** (0.007)	0.321*** (0.004)	0.482*** (0.008)	0.301*** (0.005)	0.510*** (0.122)	0.321** (0.129)
lowest price	5.113*** (0.371)		5.828*** (0.434)		5.113* (2.623)	
negotiated	-2.935** (1.069)	-15.362*** (0.526)	-3.228** (1.195)	-15.571*** (0.540)	-2.935 (3.910)	-15.362** (6.213)
nocall	-14.947*** (0.414)	-18.062*** (0.438)	-15.831*** (0.420)	-18.677*** (0.434)	-14.947*** (1.416)	-18.062*** (1.849)
restricted	-5.584*** (0.189)	-10.394*** (0.340)	-5.604*** (0.213)	-10.858*** (0.411)	-5.584*** (0.622)	-10.394*** (0.817)
local win	-1.676*** (0.287)	1.145** (0.296)	-1.567*** (0.317)	1.487** (0.358)	-1.676 (1.697)	1.145 (2.201)
<u>Province controls</u>						
population	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.001)	0.002 (0.002)
region FE	Yes	Yes	Yes	Yes	Yes	Yes
year FE	Yes	Yes	Yes	Yes	Yes	Yes
sector FE	Yes	Yes	Yes	Yes	Yes	Yes
CAtypeXregion FE	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted $R^2$	0.490	0.669	0.490	0.664	0.490	0.745
Observations	840	431	794	409	840	431

Notes: Standard errors robust to clustering at the sector level (columns (1)-(4)) or at the province level (columns (5)-(6)) are in parentheses. Column (1) reports the estimates of the model in column (3) of Table 2. Columns (2), (4), and (6) exclude the contracts awarded with the MEAT criterion. Column (3) and (4) exclude contracts with a reserve value larger than 40 million euros. The omitted category for the CA type is *utility*. The omitted category for award procedure is *open*. *Reserve price* is expressed in 10,000 euros and in 2010 equivalents. *Population* is expressed in 1,000 inhabitants. For a full description of variables see Subsection 7.1 in the Appendix. Significance levels: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Source: our elaboration on TED data.



Table 9: Winning rebate over channels, works contracts (OLS). Full estimation results.

Dep. variable	(1) win. rebate (%)	(2) win. rebate (%)	(3) win. rebate (%)	(4) win. rebate (%)	(5) win. rebate (%)	(6) win. rebate (%)
literacy	2.221*** (0.069)	3.118*** (0.059)			5.373*** (1.131)	3.588*** (0.674)
wage			-0.844*** (0.033)	-1.452*** (0.023)	7.809*** (2.027)	4.983** (1.266)
literacyXwage					-0.172*** (0.042)	-0.131*** (0.026)
<u>Auction controls</u>						
reserve price	0.000*** (0.000)	-0.001*** (0.000)	0.000*** (0.000)	-0.001*** (0.000)	0.000*** (0.000)	-0.001*** (0.000)
offers number	0.546*** (0.002)	0.418*** (0.006)	0.523*** (0.004)	0.341*** (0.006)	0.532*** (0.003)	0.345*** (0.007)
negotiated	-4.960** (1.858)	-14.259*** (0.370)	-4.143*** (1.075)	-15.430*** (0.604)	-4.620*** (0.963)	-15.549*** (0.582)
nocall	-16.427*** (0.198)	-18.430*** (0.209)	-15.816*** (0.186)	-18.317*** (0.356)	-15.816*** (0.196)	-18.326*** (0.359)
restricted	-5.786*** (0.177)	-10.878*** (0.195)	-4.908*** (0.087)	-10.423*** (0.195)	-5.195*** (0.081)	-10.393*** (0.196)
lowest price	4.789*** (0.327)		5.598*** (0.343)		5.068*** (0.290)	
local win	-1.215** (0.418)	2.158*** (0.381)	-1.093*** (0.251)	1.842** (0.404)	-0.971*** (0.260)	1.775** (0.398)
<u>Province controls</u>						
population	0.002*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.000 (0.000)	0.002*** (0.000)	0.001* (0.000)
region FE	Yes	Yes	Yes	Yes	Yes	Yes
year FE	Yes	Yes	Yes	Yes	Yes	Yes
sector FE	Yes	Yes	Yes	Yes	Yes	Yes
literacyXregion FE	Yes	Yes	No	No	No	No
wageXregion FE	No	No	Yes	Yes	Yes	Yes
Adjusted $R^2$	0.474	0.650	0.471	0.664	0.478	0.662
Observations	840	431	840	431	840	431

Notes: Standard errors robust to clustering at the sector level are in parentheses. Columns (2), (4), and (6) exclude the contracts awarded with the MEAT criterion. *literacy* is a frequency index (%) on office-related behaviors that proxy bureaucratic capabilities levels, average for CA type. *wage* is the yearly wage of employees (in euros and 2010 equivalents), average per CA type. The omitted category for award procedure is *open*. *Reserve price* is expressed in 10,000 euros and in 2010 equivalents. *Population* is expressed in 1,000 inhabitants. For a full description of variables see Table 7.1 in the Appendix. Significance levels: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ . Our elaboration on TED, NSA and ISTAT data.